

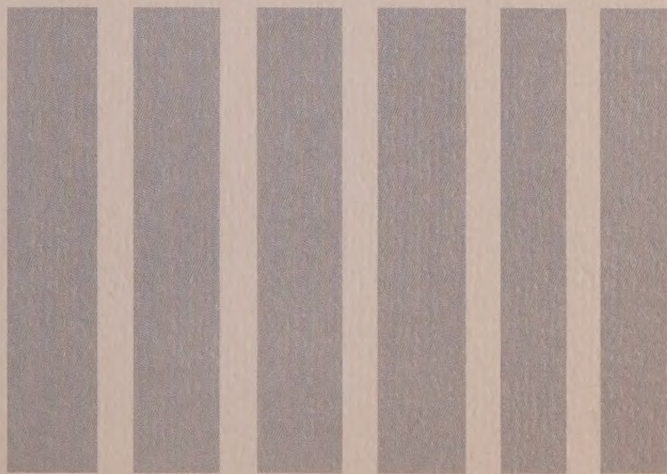


ENDEVCO
CORPORATION



INSTRUCTIONS FOR

MODEL SR1000EP
VOLTAGE REGULATED POWER SUPPLY





MODEL SR1000EP
VOLTAGE REGULATED POWER SUPPLY



The SR1000EP and SR5000EP are precision power supplies especially well-suited for installations where ground loops present a problem. Intended for excitation of multiple bridge-transducers, the Endevco Model SR1000EP regulated DC power supply is highly isolated from the AC power line. The well-regulated output voltage is adjustable from zero to 30 volts DC with vernier adjustment over each of four voltage ranges. Both the noise-to-ground and output ripple are reduced to very low values. Output current range is 0 to 1000 ma. For applications requiring a higher output current capacity, the Model SR5000EP is available which offers adjustable voltage from 0 to 36 volts with output current as high as 5 amperes.

DC POWER SUPPLIES FOR EXCITATION OF MULTIPLE BRIDGE TRANSDUCERS MODELS SR1000EP AND SR5000EP



OUTSTANDING DESIGN FEATURES

- Line and Load Regulation** Better than 0.01%
- Ripple** Less than 30 microvolts RMS
- AC Isolation** Less than 10 microvolts P-P noise will be introduced when used with a grounded 350 ohm bridge
- DC Isolation** Leakage resistance exceeds 10,000 ohms
- Reliability** Proven solid-state design assures continued trouble-free operation

The use of electrostatic shielding of the power transformer (built by Endevco to controlled specifications) provides high isolation from the AC power ground. A worthwhile addition to any equipment installation is the Model ENO-2 monitor panel. This unit permits rapid and accurate measurement and/or adjustment of transducer excitation voltage and unbalanced signals. Separate, easy-to-read null indicating meters are controlled from internal precision reference voltages in comparison with the external voltage to be measured.

TWX 213 449-3551 CABLE: ENDEVCO

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SPECIFICATIONS
MODELS SR1000EP AND SR5000EP
VOLTAGE REGULATED POWER SUPPLIES

ELECTRICAL

	SR1000EP	SR5000EP
DC VOLTAGE:	0 to 30 VDC 4 ranges plus vernier control	0 to 36 VDC 5 ranges plus vernier control.
DC CURRENT RANGE:	0 to 1000 ma	0 to 5,000 ma
OUTPUT:	Floating	Floating
OUTPUT IMPEDANCE:	Less than 0.1 ohm	Less than 0.0008 ohm
RIPPLE:	Less than 30 microvolts RMS	Less than 10 microvolts RMS
BOTH MODELS		
LINE REGULATION ¹ :	Better than .01% with line changes from 95 to 135 volts.	
LOAD REGULATION ¹ :	Better than .01% with changes from full load to no load, with sensing jumper connected on load side of output connector.	
TRANSIENT RESPONSE:	Line voltage transients within the specified range will not cause any overshoot or ringing.	
NOISE & HUM TO GROUND:	Less than 10 microvolts P-P when measured with a grounded 350-ohm bridge.	
LEAKAGE RESISTANCE:	At least 10,000 megohms.	
TEMPERATURE STABILITY ² :	Better than .005% per degree F.	
SUPPLY VOLTAGE:	95 to 135 volts, 60 cps (supply voltage) frequency may vary from 50 cps to 400 cps; however, noise specifications will deteriorate somewhat as frequency approaches 400 cps.	

PHYSICAL

MODEL SR1000EP	
DIMENSIONS:	3½" High, 8.6" Wide, 12.13" Deep.
MOUNTING:	Provision for mounting two units in Endevco Model R-14B or R14BC Rack adapter, 3½" High, 19" Wide and 16½" Deep. Blank panels (C3) should be used in vacant positions to insure proper air flow. (3 required)
BENCH USE:	Request "Hooded Connector" which contains Cable Clamp and locks to the back of the Unit.
MODEL SR5000EP	
DIMENSIONS:	5¼" High, 19" Wide, 15" Deep.
MOUNTING:	Direct rack mounting in standard 19" cabinet.

ENVIRONMENTAL

AMBIENT TEMPERATURE RANGE:	+40°F to +120°F.
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ACCESSORIES

MODEL SR1000EP
R-14B Rack Adapter is unwired except for AC power connections.
R-14BC Rack Adapter has both output leads wired to a single "MS" type connector located on the rear panel.

MODEL SR5000EP — None required.

PRICES

Model SR1000EP	\$395.00 each
Model SR5000EP	\$795.00 each
Hooded Connector	\$ 9.00 each
R14B Rack Adapter	\$ 75.00 each
R14BC Rack Adapter	\$125.00 each

Endevco Corporation reserves the right to modify these specifications
and/or prices without notice.

NOTES

¹Line and load regulations are limited to 3 mv each at output below 3 volts.
²Temperature coefficient is limited by .15 mv per degree F at output voltages
below 3 volts.

Endevco Corporation reserves the right to modify these specifications
and/or prices without notice.

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SPECIFICATION SHEET FOR MODEL SR1000EP

VOLTAGE REGULATED POWER SUPPLY

SPECIFICATIONS

Voltage Range:	0 to 30 VDC
Current Range:	0 to 1000 ma
Output:	Floating
Output Impedance:	Less than .003 ohm
Line Regulation:*	Better than .01% with line changes from 95 to 135 volts
Load Regulation:*	Better than .01% with changes from full load to no load, with sensing jumper connected on load side of output connector
Transient Response:	Line voltage transients within the specified range will not cause any overshoot or ringing, and the .01% tolerance will be maintained
Ripple:	Less than 30 μ v RMS with the line voltage ranging from 95 to 135 volts
Noise and Hum to Ground:	Less than 10 microvolts P-P when measured with a grounded 350 ohm strain gage bridge
Leakage Resistance:	At least 10,000 megohms
Temperature Stability:**	Better than .005% per degree F
Ambient Temperature Range:	+40° F to +120° F

*Line and load regulation are limited to 3 mv each at output voltages below 3 volts.

**Temperature coefficient is limited by .15 mv per degree F at output voltages below 3 volts.

Model SR1000EP Specification Sheet

Supply Voltage: 95 to 135 volts, 60 cps (supply voltage frequency may vary from 50 cps to 400 cps; however, noise specifications will deteriorate somewhat as frequency approaches (400 cps).

The Model SR1000EP is a precision supply. Isolation of the DC output from the power line makes this unit especially well suited for installations where ground loops present a problem. This feature recommends the Model SR1000EP especially for use with grounded bridge type transducers. Isolation is obtained by power transformers of Endevco's own design and manufacture.

OUTSTANDING DESIGN FEATURES

Line and Load Regulation:	Better than 0.01%
Ripple:	Less than 30 microvolts RMS
AC Isolation:	Less than 10 microvolts P-P noise will be introduced when used with a grounded 350 ohm bridge
DC Isolation:	Leakage resistance exceeds 10,000 megohms
Reliability:	Proven solid-state design assures continued, trouble free operation

PHYSICAL

Dimensions:	3.5" high, 8.6" wide, 12.13" deep
Rack Mounting Adaptors:	Provides mounting for two units 3.5" high, 19" wide, 16.4" deep. Specify Model R14B (unwired except for AC input) or R14BC (wired).
Bench Use:	Request "Hooded Connector", which contains cable clamp, and locks to the back of the unit; derate to 105° F operation, 125 V maximum.

Write to Endevco Customer Services Department for prices and delivery.

INSTRUCTION MANUAL FOR MODEL SR1000EP

VOLTAGE REGULATED POWER SUPPLY

OPERATION

The output voltage is continuously variable from 0 to 30 volts DC, by means of the five-position selector switch and fine adjustment knob on the front panel.

The momentary contact switch ("Monitor") is used to monitor the output voltage. When engaged, this switch applies the output voltage to two terminals (5 and 13) of the connector. These terminals should be connected to a monitor bus going to a precision volt meter. We recommend our Model ENO-2 Meter Monitor Panel for this purpose.

Since the wires going to the load have a certain amount of resistance, the point where regulation occurs should properly be established at the load itself. A provision has been made in Model SR1000EP to physically move the error sensing point from the unit to any point at which regulation is to be maintained. These two jumpers represent the error sensing point. For regulation measurements connect Pins 7 and 8, and Pins 15 and 16, respectively, at the point of measurement, through the use of leads from Pins 7 and 15. Thus, the regulating section of Model SR1000EP will also compensate for voltage loss in the leads.

CAUTION: Care must be taken to connect Pin 15 to Pin 16 (positive) and Pin 7 to Pin 8 (negative). An error in connection would damage the unit.

PIN CONNECTIONS

For mating connector use an Amphenol 26-4200-16S Connector, with the following pin connections:

Pins 1, 9	115 VAC
Pins 3, 4, 11, 12	Chassis Ground
Pin 5	Monitor Negative
Pin 7	External Sensing Negative, must be connected to Pin 8
Pin 8	Output Negative
Pin 13	Monitor Positive
Pin 15	External Sensing Positive, must be connected to Pin 16
Pin 16	Output Positive

NOTE: Connections from Pin 7 to Pin 8, and from Pin 15 to Pin 16, must be made by the user. These connections are not made at the factory. No output will be obtained from the supply unless these connections are made. See Caution notice above.

CIRCUIT DESCRIPTION

General

Regulation of the power supply is obtained by comparison of the output voltage with stable reference voltage through the use of a differential amplifier. Any difference voltage is amplified and the resulting signal used to correct the output voltage.

Reference Voltage

The reference voltage is obtained through the use of a three-step Zener diode circuit. The first stage of reference regulation is composed of diode CR12 and Transistor Q6. This circuit provides current to diodes CR14, CR16 and CR17 that is constant to .1% as the line regulated supply for CR15. This diode, which operates at a zero temperature coefficient condition through the proper selection of R22, provides a .01% regulated reference voltage.

Error Correction

A matched pair of transistors, Q8 and Q9, comprise the differential amplifier. A portion of the output voltage is applied to the base of Q9. This voltage is obtained from voltage divider R29, R31 and a series combination, R32, R33 and R34, determined by the position of S1. The lower end of R29 is held at the reference voltage. Any change in the output voltage produces a voltage difference between the bases of Q8 and Q9, and the amplified difference is taken from the collector of Q8.

This difference is further amplified by transistor Q7 and then applied to emitter follower Q1. The output of emitter follower Q1 is applied to medium power transistor Q2, which is used as a second emitter follower. The output of transistor Q2 is used to control series regulators Q3 and Q4. The collectors of Q1 and Q2 are supplied from the auxiliary floating supply composed of CR1 and C4. The phase of the amplified change voltage is such as to compensate for the change occurring, and thus provides .01% regulation of the output voltage.

Due to the differential nature of the input stage, temperature changes are substantially cancelled out. Diode CR13 and transistor Q5 are used to provide a regulated collector supply voltage for differential amplifier Q8 and Q9. Capacitor C8 provides high frequency rolloff to limit the high frequency response of the amplifier, preventing high frequency oscillations.

MAINTENANCE

Checkout Procedure

The following checkout techniques are used at Endevco Corporation and are recommended for your use. Instruments and equipment required are:

- 1 Oscilloscope
- 1 Volt-ohmmeter (Simpson 260 or equivalent)
- 1 Variac capable of varying AC input from 95 to 135 VAC
- 1 Stable Reference Source, such as Endevco Model SR1000EP, SR200EHP, or mercury batteries
- 1 Precision DC voltmeter, capable of reading 0 to 2.5 millivolts with adequate short term stability (Endevco Model ENO-2 or equivalent)
- 1 Battery powered, calibrated, very low noise decade amplifier

To Measure Ripple

Adjust the Model SR1000EP output voltage to 30 volts. The output ripple as measured on an RMS meter, preceded by a very low noise battery-operated decade amplifier, should be less than 30 microvolts RMS, at line voltages between 95 to 135 VAC.

Connect a 30 ohm, 50 watt resistor across the output. Repeat the above check. Ripple should be less than 30 microvolts RMS.

To Measure Line Regulation

Connect the output of the Model SR1000EP to a stable DC voltage source and precision voltmeter as shown in Figure 1. Vary the output to obtain a null (1 millivolt or less). Vary the line voltage from 95 to 135 VAC. The change in output voltage should be less than 0.01% of the output.

To Measure Load Regulation

Under the conditions stated above, connect a 30 ohm, 50 watt resistor across the output. The change in output voltage should again be less than 0.01% of the output. Interconnecting wires should be as short as possible and separate error sensing lead connections made at the load.

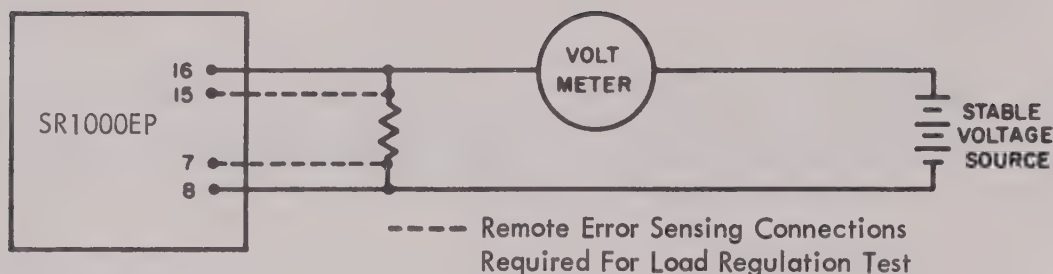


FIGURE 1

NOTE: The stable voltage source may be either another Model SR1000EP or SR200EHP operating at constant line voltage, or a suitable series of mercury cells.

To Measure Noise

Due to the extremely low noise and hum generated by the Model SR1000EP, unusual care must be exercised in the selection of test equipment and interconnecting wires. A very low noise, battery operated, decade amplifier with less than 2 microvolts of noise at a gain of 1000 should be chosen. A Tektronic Type 530 or 540 Oscilloscope provides sufficient sensitivity to monitor the output of the amplifier. If a scope is used, connect the output of the power supply to a balanced 350 ohms strain gage as shown in Figure 2. The output of the amplifier is in turn connected to the oscilloscope. All leads must be carefully shielded, as well as the strain gage. All chassis and shields are tied together as shown, and grounded at the input to the oscilloscope.

The noise contributed by the Model SR1000EP is the difference between the peak amplitudes of the oscilloscope display when the power supply is energized and when it is de-energized.

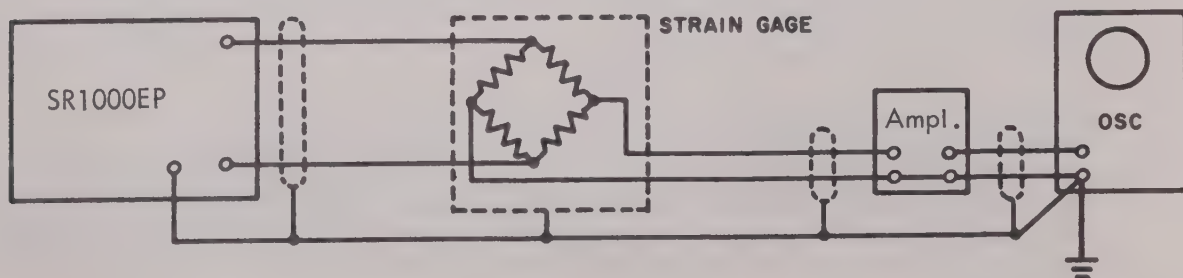


FIGURE 2

MAINTENANCE SUGGESTIONS

Since the error amplifier is a DC coupled servo loop, failure of a component in any one stage will alter the voltages in all other stages, both succeeding and preceding the point of trouble. Voltage measurements on the transistors should be made with this in mind. The point of difficulty can best be localized by looking for a stage with contradictory operation; i.e., a transistor with the base back biased, and yet the transistor is not cut off as shown by a large voltage drop across the collector load resistor.

The regulating capabilities of the power supply are used to reduce the ripple in the output by a factor of approximately 1000. As a result of this, any malfunctioning in the power supply regulating circuitry will produce excessive ripple in the output.

Parts List

The following pages present a complete replaceable Parts List for the Model SR1000EP Power Supply. Endevco Corporation reserves the right to substitute components of other manufacturers for spare parts or for new instrument production, where performance or reliability are not sacrificed.

Where Endevco is shown as the manufacturer of common types of transistors, diodes, etc., they should be procured only from Endevco since they are selected for special parameters.

When ordering parts, please specify the model and serial number of the instrument on your order.

Prices are subject to change without notice.

PARTS LIST

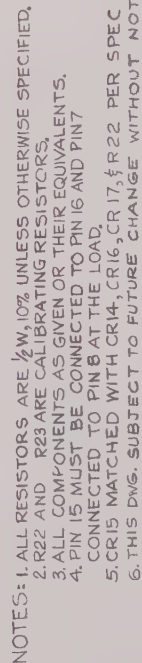
<u>Circuit Des.</u>	<u>Part</u>	<u>Value and Description</u>	<u>Manufacturer and No.</u>	<u>Endevco Part No.</u>
C1	Capacitor	25 μ f, 50 V	Sprague 89D 191	EC146
C2	Capacitor	25 μ f, 50 V	Sprague 89D 191	EC146
C3	Capacitor	2000 μ f, 50 V	Mallory HC 5020A	EC67
C4	Capacitor	1000 μ f, 12 V	Sprague TVA 1133	EC153
C5	Capacitor	250 μ f, 50 V	Mica-Mold 929-764	EC148
C6	Capacitor	250 μ f, 50 V	Mica-Mold 929-764	EC148
C7	Capacitor	250 μ f, 50 V	Mica-Mold 929-764	EC148
C8	Capacitor	1 μ f, 50 V	Sprague 89D 181	EC143
C9	Capacitor	25 μ f, 50 V	Sprague 89D 191	EC146
CR1	Rectifier		Mallory CTN100	ECR98
CR2	Rectifier		Mallory FWL100	ECR102
CR3	Rectifier		Motorola 1N3209	ECR74
CR4	Rectifier		Motorola 1N3209	ECR74
CR5	Rectifier		Motorola 1N3209	ECR74
CR6	Rectifier		Motorola 1N3209	ECR74
CR11	Zener		Endevco V1202	ECR83
CR12	Zener		Endevco V1202	ECR83
CR13	Zener		IRC 1Z8.2T10	ECR50
CR14	Zener			
CR15	Zener		Endevco 11792-7	
CR16	Diode		(Matched Set)	
CR17	Diode			
Q1	Transistor		Texas Instr. 2N1379	EQ79
Q2	Transistor		RCA 2N2147	EQ27
Q3	Transistor		Motorola 2N441	EQ28

Parts List (Continued)

<u>Circuit Des.</u>	<u>Part</u>	<u>Value and Description</u>	<u>Manufacturer and No.</u>	<u>Endevco Part No.</u>
Q4	Transistor		Motorola 2N441	EQ28
Q5	Transistor		Texas Instr. 2N1381	EQ42
Q6	Transistor		RCA 2N2147	EQ27
Q7	Transistor		RCA 3551A	EQ25
Q8	Transistor		Texas Instr. TI363	EQ43
Q9	Transistor		Texas Instr. TI363	EQ43
R1	Resistor	220 Ω , $\pm 10\%$, 1/2W, Comp.	Allen Bradley "EB"	ER191
R2	Resistor	10 K Ω , $\pm 10\%$, 1/2W, Comp.	Allen Bradley "EB"	ER304
R3	Resistor	220 Ω , $\pm 10\%$, 1/2W, Comp.	Allen Bradley "EB"	ER191
R4	Resistor	3.9 K Ω , $\pm 10\%$, 1W, Comp.	Allen Bradley "GB"	ER331
R5	Resistor	100 Ω , $\pm 10\%$, 1/2W, Comp.	Allen Bradley "EB"	ER302
R6	Resistor	27 Ω , $\pm 10\%$, 1/2W, Comp.	Allen Bradley "EB"	ER312
R7	Resistor	47 Ω , $\pm 10\%$, 1/2W, Comp.	Allen Bradley "EB"	ER29
R8	Resistor	510 Ω , $\pm 5\%$, 2W, Comp.	Allen Bradley "HB"	ER341
R9	Resistor	680 Ω , $\pm 3\%$, 3W, WW	Dalohm RS-2B	ER441
R10	Resistor	85 Ω , $\pm 1\%$, 3W, WW	Dalohm RS-2B	ER663
R11	Resistor	510 Ω , $\pm 5\%$, 2W, Comp.	Allen Bradley "HB"	ER341
R12	Resistor	2.2 K Ω , $\pm 10\%$, 1/2W, Comp.	Allen Bradley "EB"	ER311
R13	Resistor	3.3 Ω , $\pm 3\%$, 3W, WW	Dalohm RS-2B	ER754
R14	Resistor	270 Ω , $\pm 10\%$, 1/2W, Comp.	Allen Bradley "EB"	ER247
R15	Resistor	3.3 Ω , $\pm 3\%$, 3W, WW	Dalohm RS-2B	ER754
R16	Resistor	220 Ω , $\pm 10\%$, 1/2W, Comp.	Allen Bradley "EB"	ER191
R17	Resistor	2.2 K Ω , $\pm 10\%$, 1/2W, Comp.	Allen Bradley "EB"	ER311
R18	Resistor	4.7 K Ω , $\pm 10\%$, 1/2W, Comp.	Allen Bradley "EB"	ER183
R19	Resistor	6.8 K Ω , $\pm 10\%$, 1/2W, Comp.	Allen Bradley "EB"	ER282
R21	Resistor	2.2 K Ω , $\pm 10\%$, 1/2W, Comp.	Allen Bradley "EB"	ER311

Parts List (Continued)

<u>Circuit Des.</u>	<u>Part</u>	<u>Value and Description</u>	<u>Manufacturer and No.</u>	<u>Endevco Part No.</u>
R22	Resistor	Selected, $\pm 1\%$, 3W, WW	Dalohm RS-2B	---
R23	Resistor	Selected, $\pm 10\%$, 1/2W, Comp.	Allen Bradley "EB"	---
R24	Resistor	220 Ω , $\pm 10\%$, 1/2W, Comp.	Allen Bradley "EB"	ER191
R25	Resistor	4.7 K Ω , $\pm 10\%$, 1/2W, Comp.	Allen Bradley "EB"	ER183
R26	Resistor	2.2 K Ω , $\pm 10\%$, 1/2W, Comp.	Allen Bradley "EB"	ER311
R27	Resistor	2.2 K Ω , $\pm 10\%$, 1/2W, Comp.	Allen Bradley "EB"	ER311
R29	Resistor	270 Ω , $\pm 1\%$, 3 W, WW	Dalohm RS-2B	ER427
R30	Resistor	1.2 K Ω , $\pm 1\%$, 3W, WW	Dalohm RS-2B	ER436
R31	Potentiometer	1 K Ω , Ten-Turn, 3W	Voak Engrg. "AV"	ER414
R32	Resistor	300 Ω , $\pm 1\%$, 3W, WW	Dalohm RS-2B	ER428
R33	Resistor	300 Ω , $\pm 1\%$, 3W, WW	Dalohm RS-2B	ER428
R34	Resistor	750 Ω , $\pm 1\%$, 3W, WW	Dalohm RS-2B	ER432
DS1	Lamp		General Electric 1819	E17
F1	Fuse	1 amp, Slo-Blo	Littelfuse 313001	EF12
F2	Fuse	1.5 amp	Littelfuse 31301.5	EF8
S1	Switch	Rotary	Endevco 11836	11836
S2	Switch	Pushbutton	Switchcraft 3S-1356	ES33
T1	Transformer	Power	Endevco TS1118	TS1118
J1	Connector		Amphenol 26-4100-16P	EJ77



Pasadena, California

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